CLAIMS

1. A metal material comprising a diffusion layer containing an element diffused in a base material of a metal,

wherein said element is diffused from a surface to inside of said base material to a depth of not less than 0.5 mm; and

a concentration of said element is gradually decreased from said surface to said inside of said base material.

2. The metal material according to claim 1, wherein said base material is composed of any one of Zn, Zn alloy, Al, Al alloy, Mg, Mg alloy, Cu, Cu alloy, Ti, Ti alloy, Fe, and Fe alloy.

3. The metal material according to claim 2, wherein said base material is composed of said Zn alloy, and said element is at least any one of Cu and Mn.

4. The metal material according to claim 2, wherein said base material is composed of said Fe alloy, and said element is Cr.

5. The metal material according to claim 2, wherein said base material is composed of said Ti alloy, and said element is at least any one of Al, Cr, Ni, and N.

6. The metal material according to claim 2, wherein said base material is composed of said Cu alloy, and said element is Ni.

7. The metal material according to claim 3, wherein said diffusion layer further contains at least one of iron, nickel, chromium, molybdenum, cobalt, and ceramics.

8. The metal material according to claim 3, further comprising an Fe alloy layer disposed on a surface of said diffusion layer.

9. A method of producing a metal material comprising a diffusion layer which is formed by diffusing an element into a base material of a metal and which has a depth from a surface of said base material of not less than 0.5 mm, a concentration of said element being gradually decreased from said surface to inside of said base material, said method comprising:

coating said surface of said base material with a coating agent, said coating agent including a powder of a substance containing said element to be diffused, and said powder of said material being dispersed or dissolved in a solvent; and

diffusing said element into said base material by heating said base material which is coated with said substance.

10. The method of producing said metal material according to claim 9, wherein said base material is coated with a reducing agent for reducing an oxide film formed on said surface of said base material, together with said substance.

11. The method of producing said metal material according to claim 10, wherein each of resins of nitrocellulose, polyvinyl alcohol, polyvinyl, acrylic, melamine, styrene, and phenol is used as said reducing agent.

12. The method of producing said metal material according to claim 10 or 11, wherein said base material is further coated with at least one metal powder of magnesium, aluminum, or manganese, or at least one alloy powder of magnesium alloy, aluminum alloy, or manganese alloy.

13. The method of producing said metal material according to any one of claims 9 to 12, wherein said base material is heated such that a temperature gradient is formed in said diffusing step.

14. The method of producing said metal material according to any one of claims 9 to 13, wherein said diffusing step is carried out in an inert gas atmosphere.

15. The method of producing said metal material according to claim 9, wherein Zn alloy is used as said base material, at least a part of said base material is coated with a first powder containing at least any one of copper and manganese, and then the base material is coated with a second powder containing Fe in said diffusing step.

16. The method of producing said metal material according to claim 12, wherein at least one selected from Ni, Sn, Cu, and the like is further added.

17. A method of producing a metal material comprising a diffusion layer which is formed by diffusing an element into a base material of a metal and which has a depth from a surface of said base material of not less than 0.5 mm, a concentration of said element being gradually decreased from said surface to inside of said base material, said method comprising:

adding at least one of copper and manganese as a seeding agent to a molten metal when casting is performed by using said molten metal of Zn or Zn alloy.

18. The method of producing said metal material according to claim 17, wherein it takes 10 to 30 seconds to start said casting after said seeding agent is added to said molten metal.

19. The method of producing said metal material according to claim 17, wherein Cu or Mn is a powder having a particle size of 10 μm to 50 μm.

20. The method of producing said metal material according to claim 19, wherein Cu or Mn is a powder having a particle size of 10 μm to 20 μm.

21. The method of producing said metal material according to claim 17, wherein Cu is seeded in an amount of 1 % by weight to 18 % by weight of an entire amount of Zn or Zn alloy.

22. The method of producing said metal material according to claim 17, wherein Mn is seeded in an amount of 3 % by weight to 30 % by weight of said seeding agent.